REMARKS

The Amendments

In the specification and drawings, SEQ ID NO: has been added to reflect the identification of Figures 1 and 2 as SEQ ID NOS:1 and 2, respectively.

Claims 34-36, 38-40 and 48-51 are canceled. Claims 32, 33, 37 and 44 have been amended to address the Examiner's rejections in the Final Office Action. Claim 32 has been amended to recite the detection of colorectal cancer only. Detection of breast cancer claims are separately addressed in the form of new Claims 52-57. The amendments in Claim 32 are supported, for example, by page 4, lines 14-18; page 6, line 13, to page 7, line 12; page 37, lines 5-25 and original Claims 34-51. The amendments in Claim 44 are supported, for example, by page 4, lines 14-18; page 35, line 25 to page 36, line 3. New claims 52-57 are supported by original Claims 32-51; page 4, lines 14-18; page 6, line 13 to page 7, line 12; and page 37, lines 5-25.

No new matter is added in any of the above amendments. The amendments are made in response to the Examiner's rejections in the Final Office Action and raise no new issues. Applicants believe that the amendments address the Examiner's rejections and place the claims in a form for allowance or in a better form for Appeal.

The Response

Objection to Drawings

The Examiner objects to Figures 1 and 2 for failure to identify SEQ ID NO: on the figure or in the figure legend. The specification has been amended to reflect the identification of SEQ ID NO: within the figure legends and text of the specification where Figures 1 and 2 are referred to. In addition, Figures 1 and 2 have been amended to reflect the identification of SEQ ID NO: in the figures.

The Examiner further objects to the presence of holes in the vertical axis of the figure. Figures 3A-3D have been amended to eliminate the holes in the axis.

In light of the amendments above, the objections to the drawings should be withdrawn.

35 U.S.C. §112 First Paragraph Rejection

Claims 32-35, 37-39 and 41-51 are rejected under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 34-36, 38-40 and 48-51 are canceled. Claim 32 has been amended to delete any reference to breast cancer detection. Breast cancer detection is claimed separately in the form of new Claims 52-57. The rejection of the remaining claims is overcome in view of the amendments.

The Examiner states there is allegedly insufficient teaching in the prior art on how to use the methods in which expression of SEQ ID NO:1 or genes which are at least 95% identical with SEQ ID NO:1 are an indicator of breast or colorectal cancer. Applicants have amended claims 32 and 44 to remove reference to "at least 95% identical." The rejection is therefore overcome in light of the amendments.

The Examiner states that there is allegedly insufficient support in the specification to show that CHA4 expression levels are higher in breast or colorectal cancer tissue than in normal breast or colorectal tissue. Claim 32 has been amended to recite a method of "detecting" colorectal cancer. New Claim 52 separately claims a method of "detecting" breast cancer. As known by those of ordinary skill in the art, a method of detecting cancer does not require 100% sensitivity or specificity as compared to the diagnosis of a cancerous condition. Instead, tumor markers are only useful in conjunction with X-rays and other tests, as noted by the National Cancer Institute in "Cancer Facts" (attached herein as Exhibit A). Tumor markers, as known by those of ordinary skill in the art, can be elevated in people with benign conditions (see Exhibit A). Moreover, tumor markers are often times not elevated in the early stages of the disease (See Exhibit A).

Moreover, the data in Figures 3A-3D adequately support the conclusion that elevated CHA4 expression levels relative to normal tissue levels correlates with the presence of breast or colorectal cancer. For colorectal cancer, more than 85% of the colorectal cancer tissues had expression levels that were higher than normal tissue. In light of the well-known knowledge that tumor marker levels may be depressed in the early stages of the disease (see Exhibit A), this high

percentage of elevated expression in cancerous tissues sufficiently enables one of ordinary skill in the art to use CHA4 as an indicator of colorectal cancer disease detection.

The same conclusion can be found for CHA4 expression in breast cancer tissues. The Examiner states that only 17% of breast cancer tissues had expression levels higher than the highest level of normal tissue samples. However, only 2 of 7 normal breast tissue samples had levels higher than 300. As stated above, it is well-known to one of ordinary skill in the art that tumor markers can be elevated in people with benign conditions (see Exhibit A). A more appropriate value to rely upon in normal tissue, therefore, is an average of values taken over a series of individuals. Taking the average value of 220 in the instant application among the seven individual normal tissue samples, over 65% of the breast cancer tissue samples show elevated levels relative to the normal tissue samples (compare Figures 3A and 3C). In light of the well-known knowledge that tumor marker levels may be depressed in the early stages of the disease (see Exhibit A), this high percentage of elevated expression in cancerous tissues sufficiently enables one of ordinary skill in the art to use CHA4 as an indicator of breast cancer disease detection.

Further support that CHA4 is an indicator for the detection of breast cancer disease is found when comparing normal and breast cancer tissue in the same individual, which is specifically claimed in Claim 53. Figure 3A shows two individual samples, 033MAMtum and 084DAVmet with levels of approximately 325 and 450, respectively. When comparing the corresponding normal tissue samples in Figure 3C, the levels are approximately 160 and 140 respectively. Therefore, the expression levels of CHA4 from cancerous tissue of the same individual is more than two fold the levels found in normal tissue. This finding only strengthens the conclusion that one of ordinary skill in the art is sufficiently enabled to use CHA4 as an indicator of breast cancer disease detection.

With respect to Claims 44-47, the Examiner states that the specification allegedly does not teach how expression of SEQ ID NO:1 are predictive of prognosis. Applicants have amended Claim 44 to recite that wherein the expression of the gene at different cellular states is used to determine the prognosis of the individual.

Therefore, the § 112, first paragraph rejection of Claims 32, 33, 37 and 41-47 should be withdrawn.

35 U.S.C. §112 Second Paragraph Rejection

Claims 32-35, 37-39, 41-51 are rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Claims 34-40 and 48-51 are canceled. New claims 52-56 have been added to clarify the invention. The rejection of the remaining claims is overcome in view of the amendments.

Claims 32-35, 37-39, 41-43, 48-51 are allegedly indefinite over the recitation of the language "comparing the expression of said nucleic acid in the first sample to expression of said nucleic acid in a second sample; wherein an increase in expression of said nucleic acid in the first sample relative to the second sample provides a diagnosis of breast cancer or colorectal cancer in the first individual" in Claim 32. Claim 32 has been amended to specifically set forth the origin of the second sample as that of "normal breast or colorectal tissue sample."

Claims 44-47 are allegedly indefinite over the recitation "high level of expression of said sequence indicates a poor prognosis from an individual." Claim 44 has been amended to remove the term "high level of expression."

Therefore, the §112, second paragraph rejection of Claims 32, 33, 37, and 43-49 should be withdrawn.

CONCLUSION

Applicants believe that the application is in good and proper condition for allowance. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is encouraged to call the undersigned at (650) 463-8109.

Respectfully submitted,

Date: August 13, 2003

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NATIONAL CANCER INSTITUTE

Cancer Facts

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Tumor markers

Tumor markers are substances that can often be detected in higher-than-normal amounts in the blood, urine, or body tissues of some patients with certain types of cancer. Tumor markers are produced either by the tumor itself or by the body in response to the presence of cancer or certain benign (noncancerous) conditions. This fact sheet describes some tumor markers found in the blood.

Measurements of tumor marker levels can be useful—when used along with x-rays or other tests—in the detection and diagnosis of some types of cancer. However, measurements of tumor marker levels alone are **not** sufficient to diagnose cancer for the following reasons:

- Tumor marker levels can be elevated in people with benign conditions.
- Tumor marker levels are not elevated in every person with cancer—especially in the early stages of the disease.
- Many tumor markers are not specific to a particular type of cancer; the level of a tumor marker can be raised by more than one type of cancer.

In addition to their role in cancer diagnosis, some tumor marker levels are measured before treatment to help doctors plan appropriate therapy. In some types of cancer, tumor marker levels reflect the extent (stage) of the disease and can be useful in predicting how well the disease will respond to treatment. Tumor marker levels may also be measured during treatment to monitor a patient's response to treatment. A decrease or return to normal in the level of a tumor marker may indicate that the cancer has responded favorably to therapy. If the tumor marker level rises, it may indicate that the cancer is growing. Finally, measurements of tumor marker levels may be used after treatment has ended as a part of followup care to check for recurrence.

Currently, the main use of tumor markers is to assess a cancer's response to treatment and to check for recurrence. Scientists continue to study these uses of tumor markers as well as their potential role in the early detection and diagnosis of cancer. The patient's doctor can explain the role of tumor markers in detection, diagnosis, or treatment for that person. Described

below are some of the most commonly measured tumor markers.

Prostate-Specific Antigen

Prostate-specific antigen (PSA) is present in low concentrations in the blood of all adult males. It is produced by both normal and abnormal prostate cells. Elevated PSA levels may be found in the blood of men with benign prostate conditions, such as prostatitis (inflammation of the prostate) and benign prostatic hyperplasia (BPH), or with a malignant (cancerous) growth in the prostate. While PSA does not allow doctors to distinguish between benign prostate conditions (which are very common in older men) and cancer, an elevated PSA level may indicate that other tests are necessary to determine whether cancer is present.

PSA levels have been shown to be useful in monitoring the effectiveness of prostate cancer treatment, and in checking for recurrence after treatment has ended. In checking for recurrence, a single test may show a mildly elevated PSA level, which may not be a significant change. Doctors generally look for trends, such as steadily increasing PSA levels in multiple tests over time, rather than focusing on a single elevated result.

Researchers are studying the value of PSA in *screening* men for prostate cancer (checking for the disease in men who have no symptoms). At this time, it is not known whether using PSA to screen for prostate cancer actually saves lives. The National Cancer Institute-supported Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial is designed to show whether the use of certain screening tests can reduce the number of deaths caused by those cancers. For prostate cancer, this trial is looking at the usefulness of regular screening using digital rectal exams and PSA level checks in men ages 55 to 74.

Researchers are also working on new ways to increase the accuracy of PSA tests. Improving the accuracy of PSA tests could help doctors distinguish BPH from prostate cancer, and thereby avoid unnecessary followup procedures, including biopsies.

Prostatic Acid Phosphatase

Prostatic acid phosphatase (PAP) is normally present only in small amounts in the blood, but may be found at higher levels in some patients with prostate cancer, especially if the cancer has spread beyond the prostate. However, blood levels may also be elevated in patients who have certain benign prostate conditions or early stage cancer.

Although PAP was originally found to be produced by the prostate, elevated PAP levels have since been associated with testicular cancer, leukemia, and non-Hodgkin's lymphoma, as well as noncancerous conditions such as Gaucher's disease, Paget's disease, osteoporosis, cirrhosis of the liver, pulmonary embolism, and hyperparathyroidism.

CA 125

CA 125 is produced by a variety of cells, but particularly by ovarian cancer cells. Studies have shown that many women with ovarian cancer have elevated CA 125 levels. CA 125 is used primarily in the management of treatment for ovarian cancer. In women with ovarian cancer being treated with chemotherapy, a falling CA 125 level generally indicates that the cancer is responding to treatment. Increasing CA 125 levels during or after treatment, on the other hand, may suggest that the cancer is not responding to therapy or that some cancer cells remain in the body. Doctors may also use CA 125 levels to monitor patients for recurrence of ovarian cancer.

Not all women with elevated CA 125 levels have ovarian cancer. CA 125 levels may also be elevated by cancers of the uterus, cervix, pancreas, liver, colon, breast, lung, and digestive tract. Noncancerous conditions that can cause elevated CA 125 levels include endometriosis, pelvic inflammatory disease, peritonitis, pancreatitis, liver disease, and any condition that inflames the pleura (the tissue that surrounds the lungs and lines the chest cavity). Menstruation and pregnancy can also cause an increase in CA 125.

Carcinoembryonic Antigen

Carcinoembryonic antigen (CEA) is normally found in small amounts in the blood of most healthy people, but may become elevated in people who have cancer or some benign conditions. The primary use of CEA is in monitoring colorectal cancer, especially when the disease has spread (metastasized). CEA is also used after treatment to check for recurrence of colorectal cancer. However, a wide variety of other cancers can produce elevated levels of this tumor marker, including melanoma; lymphoma; and cancers of the breast, lung, pancreas, stomach, cervix, bladder, kidney, thyroid, liver, and ovary.

Elevated CEA levels can also occur in patients with noncancerous conditions, including inflammatory bowel disease, pancreatitis, and liver disease. Tobacco use can also contribute to higher-than-normal levels of CEA.

Alpha-Fetoprotein

Alpha-fetoprotein (AFP) is normally produced by a developing fetus. AFP levels begin to decrease soon after birth and are usually undetectable in the blood of healthy adults (except during pregnancy). An elevated level of AFP strongly suggests the presence of either primary liver cancer or germ cell cancer (cancer that begins in the cells that give rise to eggs or sperm) of the ovary or testicle. Only rarely do patients with other types of cancer (such as stomach cancer) have elevated levels of AFP. Noncancerous conditions that can cause elevated AFP levels include benign liver conditions, such as cirrhosis or hepatitis; ataxia telangiectasia; Wiscott-Aldrich syndrome; and pregnancy.

Human Chorionic Gonadotropin

Human chorionic gonadotropin (HCG) is normally produced by the placenta during pregnancy. In fact, HCG is sometimes used as a pregnancy test because it increases early within the first trimester. It is also used to screen for choriocarcinoma (a rare cancer of the uterus) in women who are at high risk for the disease, and to monitor the treatment of trophoblastic disease (a rare cancer that develops from an abnormally fertilized egg). Elevated HCG levels may also indicate the presence of cancers of the testis, ovary, liver, stomach, pancreas, and lung. Pregnancy and marijuana use can also cause elevated HCG levels.

CA 19–9

Initially found in colorectal cancer patients, CA 19–9 has also been identified in patients with pancreatic, stomach, and bile duct cancer. Researchers have discovered that, in those who have pancreatic cancer, higher levels of CA 19–9 tend to be associated with more advanced disease. Noncancerous conditions that may elevate CA 19–9 levels include gallstones, pancreatitis, cirrhosis of the liver, and cholecystitis.

CA 15–3

CA 15–3 levels are most useful in following the course of treatment in women diagnosed with breast cancer, especially advanced breast cancer. CA 15–3 levels are rarely elevated in women with early stage breast cancer.

Cancers of the ovary, lung, and prostate may also raise CA 15–3 levels. Elevated levels of CA 15–3 may be associated with noncancerous conditions, such as benign breast or ovarian disease, endometriosis, pelvic inflammatory disease, and hepatitis. Pregnancy and lactation can also cause CA 15–3 levels to rise.

CA 27–29

Similar to the CA 15–3 antigen, CA 27–29 is found in the blood of most breast cancer patients. CA 27–29 levels may be used in conjunction with other procedures (such as mammograms and measurements of other tumor marker levels) to check for recurrence in women previously treated for stage II and stage III breast cancer.

CA 27–29 levels can also be elevated by cancers of the colon, stomach, kidney, lung, ovary, pancreas, uterus, and liver. First trimester pregnancy, endometriosis, ovarian cysts, benign breast disease, kidney disease, and liver disease are noncancerous conditions that can also elevate CA 27–29 levels.

Lactate Dehydrogenase

Lactate dehydrogenase is a protein found throughout the body. Nearly every type of cancer, as well as many other diseases, can cause LDH levels to be elevated. Therefore, this marker cannot be used to diagnose a particular type of cancer.

LDH levels can be used to monitor treatment of some cancers, including testicular cancer, Ewing's sarcoma, non-Hodgkin's lymphoma, and some types of leukemia. Elevated LDH levels can be caused by a number of noncancerous conditions, including heart failure, hypothyroidism, anemia, and lung or liver disease.

Neuron-Specific Enolase

Neuron-specific enolase (NSE) has been detected in patients with neuroblastoma; small cell lung cancer; Wilms' tumor; melanoma; and cancers of the thyroid, kidney, testicle, and pancreas. However, studies of NSE as a tumor marker have concentrated primarily on patients with neuroblastoma and small cell lung cancer. Measurement of NSE level in patients with these two diseases can provide information about the extent of the disease and the patient's prognosis, as well as about the patient's response to treatment.

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Sources of National Cancer Institute Information

Cancer Information Service
Toll-free: 1–800–4–CANCER (1–800–422–6237)
TTY (for deaf and hard of hearing callers): 1–800–332–8615

NCI Online
Internet
Use http://cancer.gov to reach NCI's Web site.

CancerMail Service
To obtain a contents list, send e-mail to cancermail@icicc.nci.nih.gov with the word "help" in the body of the message.

CancerFax® fax on demand service
Dial 301–402–5874 and listen to recorded instructions.